**Teacher Resource Pack**

**Unit Planning Resources**

**Subject Area/Grade:** Physical Science, grade 5 **Title:** Matter and Energy **Estimated Time Frame:** \_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Unit Theme:**  **Conceptual Lens:**    **Identify the Big Ideas:**  *(Align to Essential Standards)*  \*Systems, Order and organization  Matter transformation  Energy transformation  Cycling of Matter  Conservation of Matter | **GRAPHIC ORGANIZERS:**  NC Science Essential Standards; Physical Science Domain; Matter: Properties and Change Strand  Atlas of Science Literacy page 57, 61 Volume I – page 21 and 25 Volume II  Energy from the Sun <https://files.oakland.edu/users/jthomas3/web/inspiration.html>  part  Water Cycle graphic organizer <http://ga.water.usgs.gov/edu/watercyclehi.html>  Qwiki graphic organizers:  Matter <http://www.qwiki.com/q/#!/Matter>  Energy <http://www.qwiki.com/q/#!/Energy> | | | |
| **Enduring Understanding**  *(Generalizations)*  The Universe consists of matter and energy, which is continually being changed and transferred throughout the Earth and Universe.  The Sun is the major source of energy for the Earth. Energy from the Sun drives the water cycle.  No matter how parts of an object are assembled, the weight of the whole object is always the same as the sum of the parts; and when an object is broken into parts, the parts have the same total weight as the original object.  Matter has many properties and can be changed. Changes in matter can be described in terms of physical and chemical properties. When a new material is made by combining two or more materials, it has properties that are different from the original materials. | **NC Science Essential Standards**  **5.P.2 Understand the interactions of matter and energy and the changes that occur.**  5.P.2.1 Explain how the sun’s energy impacts the processes of the water cycle (including evaporation, transpiration, condensation, precipitation and runoff).  5.P.2.2 Compare the weight of an object to the sum of the weight of its parts before and after an interaction.  5.P.2.3 Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred. | **Essential Questions**  *(Guiding Questions)*  Why is the Sun important? How does the Sun impact the Earth?  What is the water cycle? Why is the water cycle an important process for Earth? How is the Sun connected to the water cycle?  What is matter? What is mass? What is weight? How are mass and weight related?  How can we describe matter?  How can matter be changed?  How can we describe the changes that take place in matter? | | |
| **Student Essential Terminology**  evaporation  transpiration  condensation  precipitation  runoff  matter  energy | | | |
| **Identify Misconceptions**  \*Construct formative assessment probes – see ‘how to’ on pages 85, 102, and 183 in Science Formative Assessment by Page Keeley.  Use formative probes: Uncovering Student ideas in Science, Volumes 1-4, by Page Keeley  (I) Volume1 Ice Cubes in a Bag p. 49 (II) Volume 1 Lemonade p. 55 (III) Volume 1 Cookie Crumbles, p. 61 (IV) Volume 1 Seedlings in a Jar p. 67 (V) Volume 1 Is it Melting? P. 73 (VI) Volume 1 Is it Matter? P. 79 (VII) Volume 1 Is it Made of Molecules? P. 85 (VIII) Volume 1 The Rusty Nails p. 91 (IX) Volume 1 Wet jeans p. 155 (X) Volume 4 Sugar Water p. 11 (XI) Volume 4 Burning Paper p. 23 (XII) Volume 4 Nails in a Jar p. 31 (XIII) Volume 4Standing on One Foot p. 61  Formative Assessment Probes (articles, how-to, free-online) by Page Keeley, et al <http://pal.lternet.edu/docs/outreach/educators/education_pedagogy_research/assessment_probes_uncovering_student_ideas.pdf>  <http://www.ode.state.or.us/teachlearn/subjects/science/resources/msef2010-formative_assessment_probes.pdf> | | | | |
| **Unpacked Content** | **Science For All Americans** | | **Benchmarks Reference** | |
| 5.P.2.1  Students know that the sun provides the energy that is a driving force for most biotic and abiotic cycles on the surface of the earth. Students know that the sun’s energy fuels the water cycle and impacts different aspects of the water cycle (evaporation, transpiration, condensation, precipitation).  5.P.2.2  Students know that the weight of an object is equal to the weight of the sum of its parts. This is true in all closed systems.  5.P.2.3  Students know that by making qualitative and quantitative data records, we are able to create before/after representations of materials (and their properties), so that we can compare before/after versions of materials. | **THE EARTH**  The earth has a variety of climatic patterns, which consist of different conditions of temperature, precipitation, humidity, wind, air pressure, and other atmospheric phenomena. These patterns result from an interplay of many factors. The basic energy source is the heating of land, ocean, and air by solar radiation. Transfer of heat energy at the interfaces of the atmosphere with the land and oceans produces layers at different temperatures in both the air and the oceans. These layers rise or sink or mix, giving rise to winds and ocean currents that carry heat energy between warm and cool regions. The earth's rotation curves the flow of winds and ocean currents, which are further deflected by the shape of the land.  The cycling of water in and out of the atmosphere plays an important part in determining climatic patterns—evaporating from the surface, rising and cooling, condensing into clouds and then into snow or rain, and falling again to the surface, where it collects in rivers, lakes, and porous layers of rock. There are also large areas on the earth's surface covered by thick ice (such as Antarctica), which interacts with the atmosphere and oceans in affecting worldwide variations in climate. STRUCTURE OF MATTER The things of the physical world seem to be made up of a stunningly varied array of materials. Materials differ greatly in shape, density, flexibility, texture, toughness, and color; in their ability to give off, absorb, bend, or reflect light; in what form they take at different temperatures; in their responses to each other; and in hundreds of other ways. Yet, in spite of appearances, everything is really made up of a relatively few kinds of basic material combined in various ways. As it turns out, about 100 such materials—the chemical elements—are now known to exist, and only a few of them are abundant in the universe.  When two or more substances interact to form new substances (as in burning, digestion, corrosion, and cooking), the elements composing them combine in new ways. In such recombinations, the properties of the new combinations may be very different from those of the old. An especially important kind of reaction between substances involves combination of oxygen with something else—as in burning or rusting.  The basic premise of the modern theory of matter is that the elements consist of a few different kinds of atoms—particles far too tiny to see in a microscope—that join together in different configurations to form substances. There are one or more—but never many—kinds of these atoms for each of the approximately 100 elements.  There are distinct patterns of properties among the elements. There are groups of elements that have similar properties, including highly reactive metals, less-reactive metals, highly reactive non-metals (such as chlorine, fluorine, and oxygen), and some almost completely nonreactive gases (such as helium and neon). Some elements don't fit into any of these categories; among them are carbon and hydrogen, essential elements of living matter. When the elements are listed in order by the masses of their atoms, similar sequences of properties appear over and over again in the list. | | 4B  4D | |
| **North Carolina Connections:** (local and state resources)  [**Catawba Science Center**](http://www.catawbascience.org/) CSC also provides a variety of educational and fun programming for school groups, children, families, adults, and other community groups. 243 3rd Avenue NE (street address), P.O. Box 2431, Hickory, NC 28603, (828) 322-8169  [**Imagination Station Science Museum**](http://www.imaginescience.org/) Interactive programs are designed to promote student investigation into various science concepts. 224 East Nash Street,Wilson, NC 27894 Phone (252) 291-5113.  [**North Carolina Museum of Life and Science**](http://www.ncmls.org/) Experience how inquiry-based teaching energizes your students and encourages science discovery. 433 West Murray Avenue (street address), P.O. Box 15190, Durham, NC 27704, (919) 220-5429  [**SciWorks, the Science Center and Environmental Park of Forsyth County**](http://www.sciworks.org/) Enjoy interactive, hands-on special exhibits and programs in spacious exhibit halls. 400 West Hanes Mill Rd., Winston-Salem, (336) 767-6730  **North Carolina NASA Educator Resource Center** J. Murrey Atkins Library UNC Charlotte 9201 University City Blvd., Charlotte, NC 28223 704-687-2559 | | | | |
| **Annotated TEACHER Resources**  [**NOAA Water Cycle Game**](http://prisms.mmsa.org/review.php?rid=1308)  <http://prisms.mmsa.org/review.php?rid=1308>  The resource is a role-playing game in which students take on the role of a water molecule and travel through nine compartments of the water cycle to gain a better understanding for the true complexity of the movement of water.  [**The Water Cycle**](http://prisms.mmsa.org/review.php?rid=1291)  <http://prisms.mmsa.org/review.php?rid=1291>  The representation features a detailed six minute animated lesson about the major processes that move water between land, the ocean and the atmosphere, and convert water between states. Evaporation, condensation, transpiration and water reservoirs are major topics covered by the animation.  [**Thirstin's Water Cycle: Rain**](http://prisms.mmsa.org/review.php?rid=1319)  <http://prisms.mmsa.org/review.php?rid=1319>  The representation is an animation of the water cycle. The user can select individual parts, such as: rain, water vapor, water storage and clouds. The user can observe water as it cycles through the various parts of the water cycle. This review focuses on "R for Rain."  [**The Hydrologic Cycle**](http://prisms.mmsa.org/review.php?rid=1283)  <http://prisms.mmsa.org/review.php?rid=1283>  The representation is an animation depicting the water cycle. The first page is an introduction with links to pages on condensation, precipitation, infiltration, runoff and evaporation and transpiration.  [**A Summary of the Hydrologic Cycle**](http://prisms.mmsa.org/review.php?rid=1301)  <http://prisms.mmsa.org/review.php?rid=1301>  The representation is an animation of the water cycle, accompanied by a descriptive text that includes the topics of evaporation, condensation, precipitation, and transport using an additional diagram.  [**NOAA Water Cycle Game**](http://prisms.mmsa.org/review.php?rid=1307)  <http://prisms.mmsa.org/review.php?rid=1307>  The resource is a role-playing game in which students take on the role of a water molecule and travel through nine compartments of the water cycle to gain a better understanding for the true complexity of the movement of water  [**Demonstration of Specific Matter Properties**](http://www.cmhouston.org/attachments/files/2097/Demonstration%20of%20Specific%20Properties%20of%20Matter.pdf)  [http://www.cmhouston.org/attachments/files/2097/Demonstration%20of%20Specific%20Prope ...](http://www.cmhouston.org/attachments/files/2097/Demonstration%20of%20Specific%20Properties%20of%20Matter.pdf)  This group of educator-led demonstrations involving common objects will help learners become more familiar with the properties of magnetism, conductivity, density, opacity, buoyancy, and elasticity. This lesson plan includes background information and key vocabulary and definitions. The demonstration may be used to enhance learning that happens before or after a visit to the Matter Factory exhibit ...  [**What are Physical Properties and Changes?**](http://www.elmhurst.edu/~chm/vchembook/104Aphysprop.html)  <http://www.elmhurst.edu/~chm/vchembook/104Aphysprop.html>  This short reference article describes, defines and lists several physical properties and physical changes. Photographs are included.  [**Water Properties**](http://ga.water.usgs.gov/edu/waterproperties.html)  <http://ga.water.usgs.gov/edu/waterproperties.html>  Simple description of the chemical and physical properties of water produced by the U.S. Geological Survey.  [**Investigating Changes of State: Chemical and Physical Changes**](http://serc.carleton.edu/sp/mnstep/activities/20101.html)oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-025  <http://serc.carleton.edu/sp/mnstep/activities/20101.html>  In this activity students explore and identify chemical and physical changes by observing a variety of changes in matter in lab stations and through the making of butter and pancakes.  [**Physical and Chemical Changes**](http://ia.usu.edu/viewproject.php?project=ia:15350)  oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-111-990  <http://ia.usu.edu/viewproject.php?project=ia:15350>  Physical and chemical changes in matter affect us every day. Use the following resources to help you understand these changes more completely.  [**Chemistry: classifying chemical and physical changes in various materials/substances**](http://serc.carleton.edu/sp/mnstep/activities/26440.html)  oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-025  <http://serc.carleton.edu/sp/mnstep/activities/26440.html>  This activity is a classroom lab where students observe and classify chemical and physical changes using the five characteristics of a chemical change, interpret their findings, and use evidence to support their findings.  [**Forgotten Genius**](http://www.pbs.org/wgbh/nova/teachers/activities/pdf/3402_julian.pdf)  <http://www.pbs.org/wgbh/nova/julian/program.html>  This is a 2 hour program divided into 13 chapters, describing the life and accomplishments of Percy Julian.  oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-013  <http://www.pbs.org/wgbh/nova/teachers/activities/pdf/3402_julian.pdf>  This series of chemistry stations are designed to accompany the PBS documentary about African-American chemist "Percy Julian: Forgotten Genius." Each of the six stations features either a chemical or physical change: mixing vinegar and metals (chemical), baking soda and vinegar (chemical), antacid tablets and water (chemical), cabbage juice indicator and...  [**The Magic of Matter**](http://ia.usu.edu/viewproject.php?project=ia:7086)  Discover what matter is, the different kinds of matter, and how it changes. Your assignment - have fun with matter!  oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-111-990  <http://ia.usu.edu/viewproject.php?project=ia:7086>  **Smart Exchange**  <http://exchange.smarttech.com/search.html>  A directory of Smart Board lessons that teachers can download and use.  **Teachers Domain**  Free digital media for educational use.  <http://www.teachersdomain.org/>  [**Mystery Mud: Exploring Changes in States of Matter**](http://www.teachersdomain.org/resource/phy03.sci.phys.matter.mud/)  <http://www.teachersdomain.org/resource/phy03.sci.phys.matter.mud/>Join a group of middle-school students on a visit to a laboratory at the Massachusetts Institute of Technology, where they experiment with "mystery mud" and learn about the relationships between magnetism, particle motion, and changes in the state of matter.  [**Barfing Pumpkin**](http://www.teachersdomain.org/resource/odc08.scitech.matter-energy.barfingpumpkin/)  <http://www.teachersdomain.org/resource/odc08.scitech.matter-energy.barfingpumpkin/>  This demonstration shows a chemical change with hydrogen peroxide decomposing into water and oxygen.  **Bill Nye Phases of Matter (1,2,&3)**  <http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7685>  **Bill Nye Chemical Reactions (1,2, &3)**  <http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7907>  **Essential Science for Teachers: Physical Science**  <http://www.learner.org/resources/series200.html>  *Physical Science* consists of eight one-hour video programs accompanied by print and Web materials that provide in-class activities and homework explorations. Real-world examples, demonstrations, animations, still graphics, and interviews with scientists compose content segments that are intertwined with in-depth interviews with children that uncover their ideas about the topic at hand. Each program also features an elementary school teacher and his or her students exploring the topic using exemplary science curricula. Use the complete course for teacher education or professional development, or individual programs for content review. | | | | |
| **WRITING PROMPTS**   1. Many people have favorite foods that they snack on. Do you have a favorite snack food? Describe your favorite snack food. Explain what you think is in your snack food that makes it so appealing to you. 2. Imagine you are a drop of water falling from the sky as rain. Describe your adventure as you land on the earth, move towards the ocean, and ultimately are evaporated or transpired back into the atmosphere. 3. You have decided to bake a batch of cupcakes to share with your friends at school. Describe the process you will go through to prepare the cupcakes for your classmates. 4. After burning for 3 hours, a candle has lost half of its mass. Write an essay explaining where the mass has gone. 5. Your mom has asked you to clean the sliding glass doors that lead out to your play area in the yard. However, there is no window cleaner left in the bottle. Your mom tells you that you can mix water with white vinegar or the juice from a lemon to make some home-made window cleaner. Which of these household chemicals would you use, and why? | | | | |